

Summary of Parameters for the Shower Max Digitizer Crates Power

Craig Drennan
August 8, 2000

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Summary of Parameters for the Shower Max Digitizer Crates Power

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Introduction

The Shower Max digitizer crates are mounted to the face of each wedge in the Central Detector and in 12 positions around the face of each end plug. The crates are powered by the "Rabbit" power supplies used in the previous collider run. One Type A Rabbit power supply provides the +5 VDC and +/- 15 VDC power, and one Type B Rabbit power supply provides the +/- 7.5 VDC. Power cable harnesses were made to connect the power supplies to the Shower Max Crates. These harnesses were constructed by modifying the Rabbit crate harnesses used in the previous collider run.

Below is a summary of the parameters of the power supplies and the power harness components. Documents included with this note include copies of the power supply manuals and the instructions used to modify the old rabbit cable harnesses for the Shower Max application.

The Power Supplies

Type A Supply

Input:

208 VAC, 3 phase, 400 Hz

Outputs:

+ 5.500 Volts @ 30.0 Amps

- 5.500 Volts @ 30.0 Amps

+15.50 Volts @ 3.0 Amps

-15.50 Volts @ 3.0 Amps

Output Protection:

+/-5.5 Volt Overcurrent Shutdown Mode

When the rated output current threshold is exceeded (including a dead short) the supply goes into overcurrent shutdown mode. The current is held at or below a preset maximum value, and the voltage is reduced proportionally with load resistance. The increased voltage drop across the pass transistors causes their temperature to rise dramatically. A thermostat will disable the driver outputs (at approx. 120 degC) before the transistors are damaged. After the temperature has dropped (approx. 30 seconds) the supply will automatically restart. The thermal shutdown mechanism will continue to protect the supply until the overload condition is removed. The supply will then resume normal operating mode. The circuit breaker will not trip in response to an overload condition.

+/- 15.5 Volt Overcurrent Shutdown Mode

When the rated output current threshold is exceeded (including a dead short) a fault delay period of approximately 3 seconds is initiated. If the overcurrent fault is removed before the end of the fault delay period, the supply will resume normal operation with no output interruption. If the overcurrent fault is not

removed before the end of the fault delay period, the driver outputs are disabled. To re-enable the driver outputs, the primary power must be turned off for approximately 10 second before making a restart attempt.

Over Voltage Protection

If a shorted rectifier or pass transistor should occur, the output voltage rise will be less than 3 volts or 30%, whichever is greater. This is achieved through the close rail/output voltage. Because of the over voltage / transient voltage protection used on the Shower Max circuits and over voltage condition will likely result in an over current condition that will then be acted on in accordance with the overcurrent shutdown modes of the supply.

- Further circuit details of the overcurrent and over voltage protection is given in the power supply manuals.

Type B Supply

Input:

208 VAC, 3 phase, 400 Hz

Outputs:

+ 7.500 Volts @ 25.0 Amps

-7.50 Volts @ 25.0 Amps

Output Protection:

+/- 7.5 Volt Overcurrent Shutdown Mode

When the rated output current threshold is exceeded (including a dead short) the supply goes into overcurrent shutdown mode. The current is held at or below a preset maximum value, and the voltage is reduced proportionally with load resistance. The increased voltage drop across the pass transistors causes their temperature to rise dramatically. A thermostat will disable the driver outputs (at approx. 120 degC) before the transistors are damaged. After the temperature has dropped (approx. 30 seconds) the supply will automatically restart. The thermal shutdown mechanism will continue to protect the supply until the overload condition is removed. The supply will then resume normal operating mode. The circuit breaker will not trip in response to an overload condition.

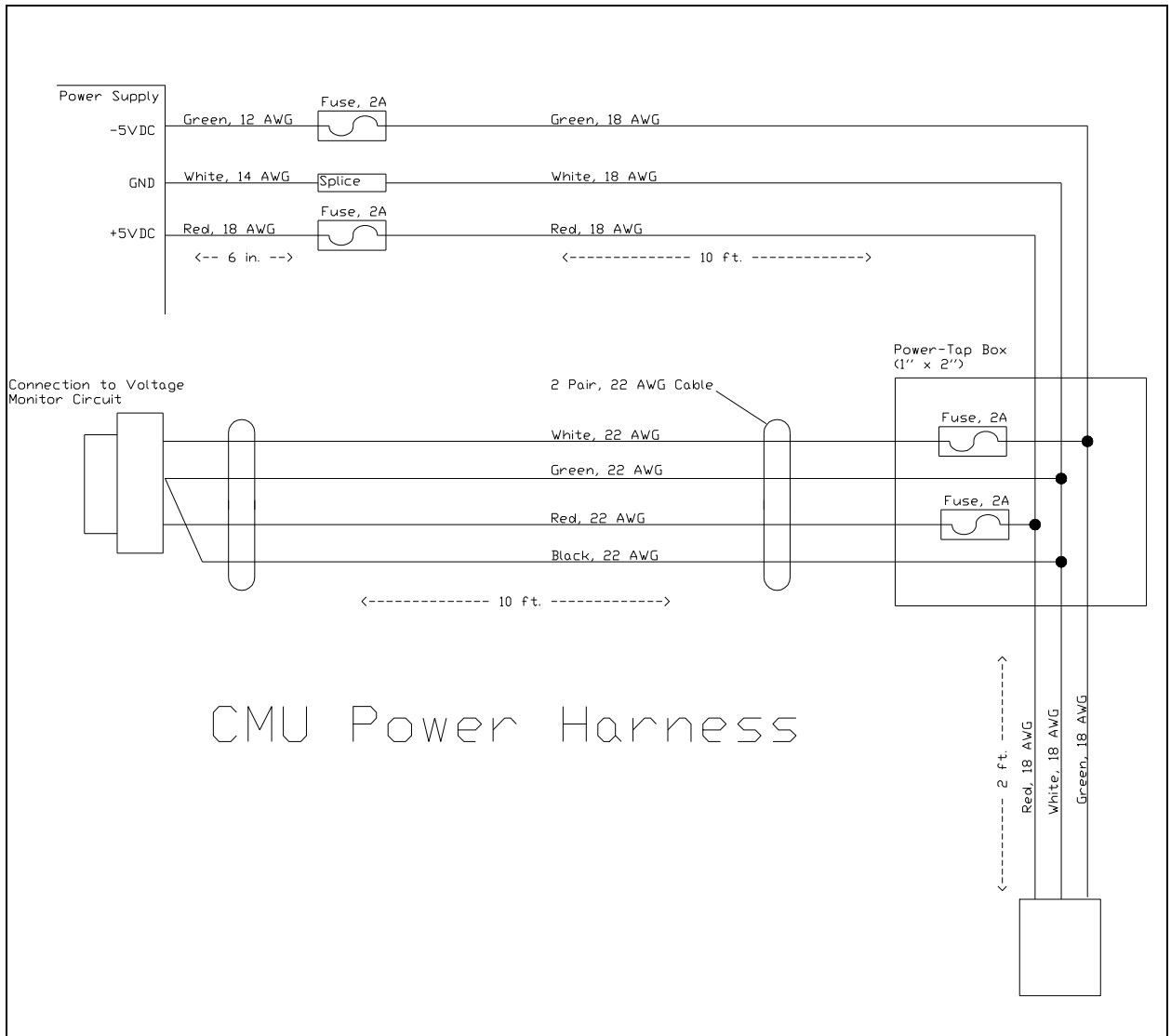
Over Voltage Protection

If a shorted rectifier or pass transistor should occur, the output voltage rise will be less than 3 volts or 30%, whichever is greater. This is achieved through the close rail/output voltage. Because of the over voltage / transient voltage protection used on the Shower Max circuits and over voltage condition will likely result in an over current condition that will then be acted on in accordance with the overcurrent shutdown modes of the supply.

- Further circuit details of the overcurrent and over voltage protection is given in the power supply manuals.

The Power Cable Harnesses

The power harnesses for the Central SMD crates differ from those for the Plug SMD crates only in that the Central power harnesses include three wires that deliver +/-5.5 Volts and reference ground to the CMU pre-amplifiers. The Plug power harness does not include any -5.5 Volt wires. All of the wire used in the harnesses are the same part number (12 AWG) except for the CMU power wires. The CMU portion of the harness is shown in the figure below. The arrangement of the rest of the harness is given in the "Shower Max Central 400 Hz Power Harness Modification Instructions", March 16, 1999, and the "Shower Max Plug 400 Hz Power Harness Modification Instructions", May 19, 1999. We are relying on the overcurrent protection of the power supplies to protect the wires in the cable harness.



The Wire Number and Rating

Atlas Wire E25635 AWM STYLE 1015, 600 V, 105 degC, VW-1, CSA, 12 AWG

Note that the 12 AWG wire used has an insulation temperature rating of 105 degC. Table 310-16 of the National Electric Code indicates that the increased temperature rating allows for 30 Amps on this 12 AWG wire. Also the VW-1 indicates that the wire passes the Vertical Wire Flame Test.

The ConnectorsPower Supply Connector:

Anderson Powerpole connector model PP30. These connection are rated for 30 Amps

+/-15 VDC Transition Card connection:

AMP Power Lock Series I, AMP#54489-2 (shell) and AMP#53892-4 (crimp contact). These connections are rated for 31 Amps.

Backplane Connection:

Solderless ring tongue terminals on Schroff backplane power bus terminals M4 bolt on connection. These connections meet the VME specification to which our circuit boards were designed (IEEE STD1014-1987)

CMU Power Connection:

Standard Inline Fuses and butt splices. Connection to voltage tap box and pre-amp circuit uses Molex parts Receptacle 03-06-1038, Plug 03-06-2033, Male Crimp Terminal 02-06-2103, Female Crimp Terminal 02-06-1103. These connections are rated for 5 Amps.

Shower Max Central 400 Hz Power Harness Modification Instructions

March 16, 1999

The following instructions provide the steps needed to recycle the Rabbit crate harnesses for use with the Shower Max crates on the Central detector. There are 3 harnesses used for every Shower Max crate. Two connect to the type A supply and one connects to the type B supply

Care should be taken when choosing the harnesses to determine the correct length. There should be plenty to choose from, as the Shower Max crate will only use $\frac{1}{2}$ the number of power supplies as did the Rabbit system. The wires need to be routed straight down through the top of the Shower Max crates between the shrouds of the backplane connectors to the power lugs on the backplane.

These harnesses were fabricated with *Anderson Powerpole* connectors at the power supply end and ring terminals at the crate end. The Powerpole connectors are modular by design and allow for removal of a given wire and its connector.

When removing a wire from the harness, remove the single pole modular connector from the cluster housing. This is done by removing the retaining pin from the housing and sliding off the desired connector and replacing the cluster back in the housing and reinstalling the retaining pins.

The Harness for the "A" type supply requires 2 harnesses, 1 for each connector on the power supply. These 2 identical harnesses will be reconfigured into A1 & A2, which will be different after the modification.

The harness wires connect to the 400 Hz supplies at one end and connects to the SMD Shower Max crate at two different locations.

1. The backplane.
2. The SMC Transition card using AMP high current connectors (Cable Harness A1).

There are also three wires that will be run to the CMU preamplifiers. These will have inline fuse holders crimped onto the existing #12 wires approximately 6" from the power supply and 11 foot, #18 wires will crimp to the other end of the fuse and extend to the CMU preamplifiers.

A1 Cable Harness

Power Supply Connector Modification:

1. Replace the +5v (yellow) contact in the power supply connector with a contact having the Yellow #12 wire and a Red #18 wire crimped together. The #12 wire will go to the SMD Crate, and the #18 wire will go to supply the CMU.

Connection to Crate:

Wires dedicated to supplying power to CMU.

1. -5v (green #12) cut 6 inches from the power supply connector and crimped to one end of an inline fuse. An 11 foot green #18 wire is crimped to the other end of the fuse holder.
2. GND (white #14) cut 6 inches from the power supply connector and connected to an 11 foot white #18 wire using a butt splice connection.
3. +5v (red #18) cut 6 inches from the power supply connector and crimped to one end of an inline fuse. An 11 foot red #18 wire is crimped to the other end of the fuse holder.

Connect with ring terminals to backplane power bugs.

1. +5v (yellow #12) connect to backplane, right most +5V terminal.
2. GND (white #12) connect to backplane, right most GND terminal.

Terminate into 2 Pos. AMP Connector #54489-2, using crimp contact #53892-4.

- | | |
|-----------------|------------|
| 5. +15v (red) | Circuit 1. |
| 6. -15v (black) | Circuit 2. |

A2 Cable Harness

Power Supply Connector Modification:

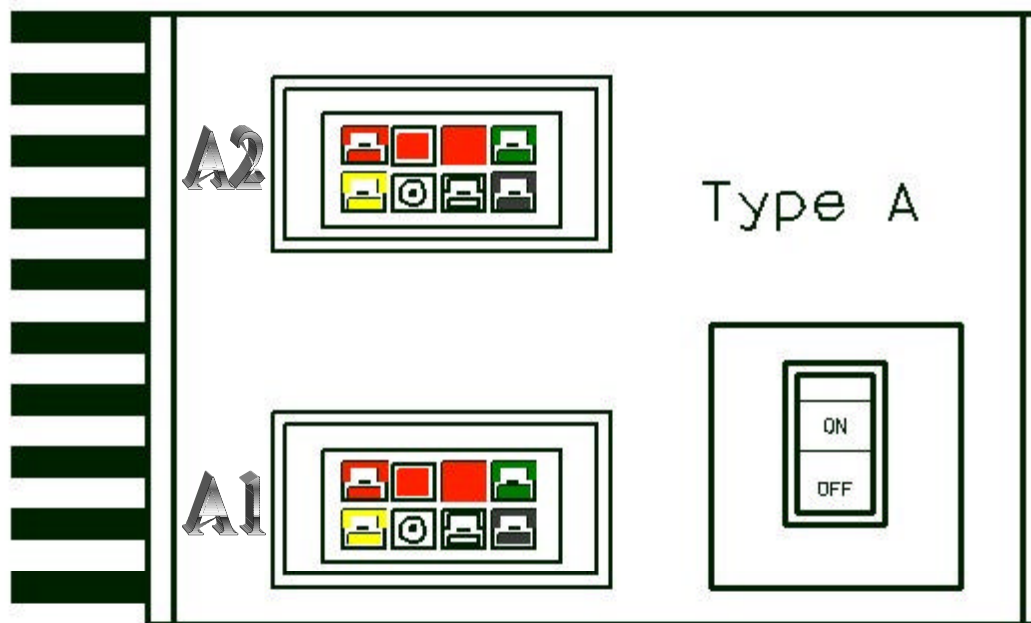
Remove the following wires by clipping them as close as possible at the rear of the insert within the cluster housing.

1. -5v (green #12)
2. +15v (red #12)
3. -15v (black #12)
4. GND (white #14)

Connection to Crate:

Connect with ring terminals to backplane power bugs.

3. +5v (yellow #12) connect to backplane, left most +5V terminal.
4. GND (white #12) connect to backplane, left most GND terminal.



A1 Cable Harness



A2 Cable Harness

B1 Cable Harness

Power Supply Connector Modification:

Remove the following wire by clipping it as close as possible at the rear of the insert within the cluster housing.

1. -8v (blue #12), the shorter of the two blue wires, 27 inches long.

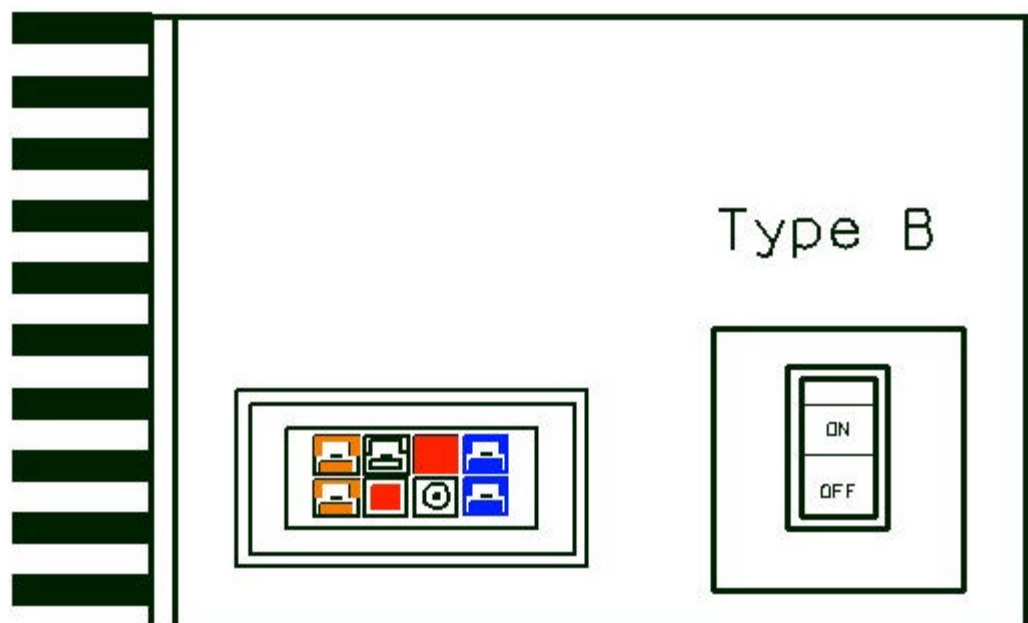
Replace the following wires with 37 inch long #12 wires.

2. +8 (orange #12), the shorter of the two orange wires, 27 inches long.
3. GND (white #12), the shorter of the two white wires, 27 inches long

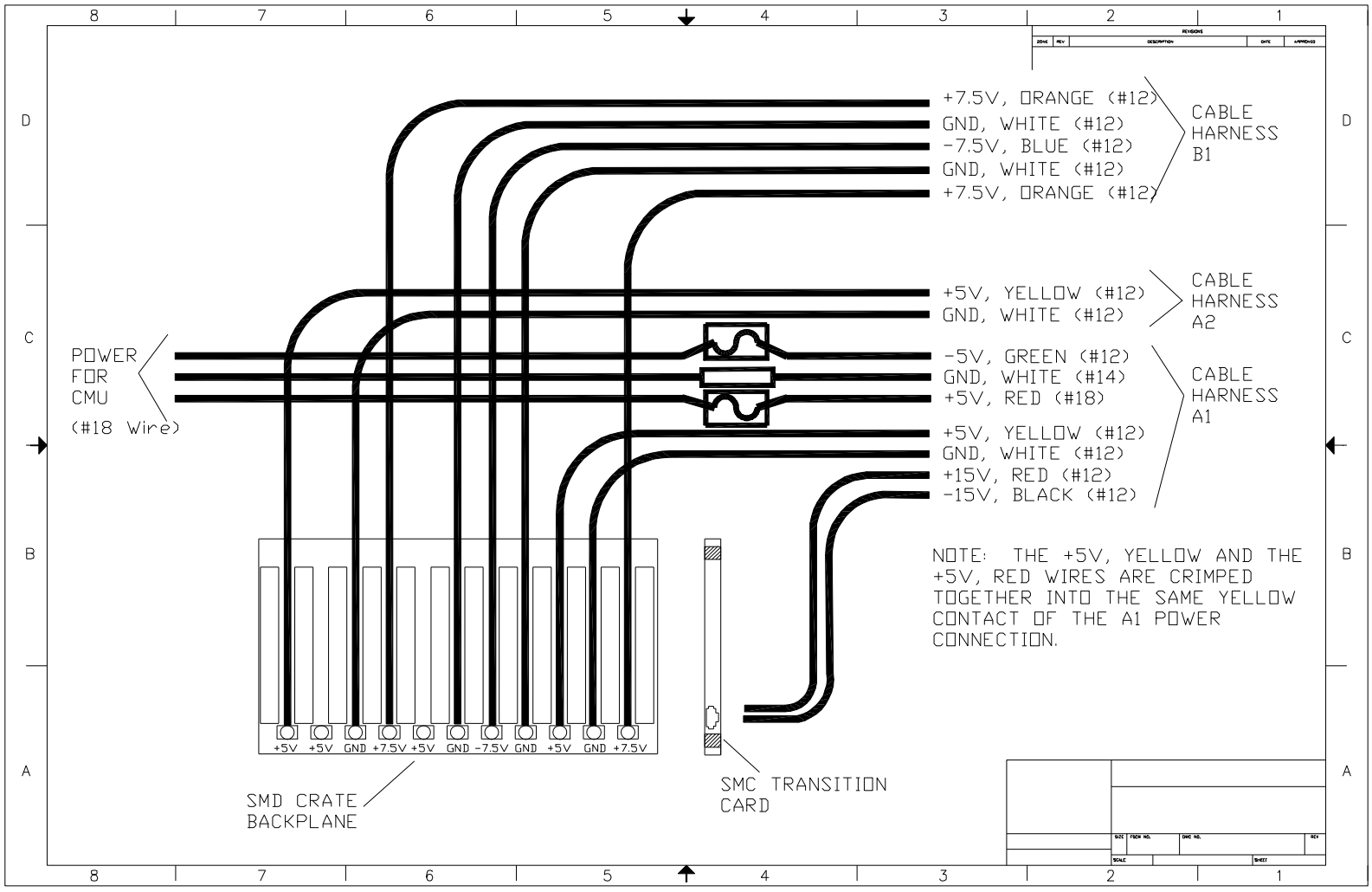
Connection to Crate:

Connect with ring terminals to backplane power bugs.

1. +8 (orange #12) connect to backplane, left most +7.5V terminal.
2. +8 (orange #12) connect to backplane, right most +7.5V terminal.
3. -8 (blue #12) connect to backplane, sole -7.5V terminal.
4. GND (white #12) connect to backplane, GND terminal to right of -7.5V terminal.
5. GND (white #12) connect to backplane, GND terminal to left of -7.5V terminal.



B1 Cable Harness



Shower Max Plug 400 Hz Power Harness Modification Instructions

May 19, 1999

The following instructions provide the steps needed to recycle the Rabbit crate harnesses for use with the Shower Max crates on the Plug. There are 3 harnesses used for every Shower Max crate. Two connect to the type A supply and one connects to the type B supply

Care should be taken when choosing the harnesses to determine the correct length. There should be plenty to choose from, as the Shower Max crate will only use $\frac{1}{2}$ the number of power supplies as did the Rabbit system. The wires need to be routed straight down through the top of the Shower Max crates between the shrouds of the backplane connectors to the power lugs on the backplane.

These harnesses were fabricated with *Anderson Powerpole* connectors at the power supply end and ring terminals at the crate end. The Powerpole connectors are modular by design and allow for removal of a given wire and its connector.

When removing a wire from the harness, remove the single pole modular connector from the cluster housing. This is done by removing the retaining pin from the housing and sliding off the desired connector and replacing the cluster back in the housing and reinstalling the retaining pins.

The Harness for the "A" type supply requires 2 harnesses, 1 for each connector on the power supply. These 2 identical harnesses will be reconfigured into A1 & A2, which will be different after the modification.

The harness wires connect to the 400 Hz supplies at one end and connects to the SMD Shower Max crate at two different locations.

1. The backplane.
2. The SMC Transition card using AMP high current connectors (Cable Harness A1).

A1 Cable Harness

Power Supply Connector Modification:

Remove the following wires by clipping them as close as possible at the rear of the insert within the cluster housing.

1. -5v (green #12)
2. GND (white #14)

Note: All remaining wires longer than 28 inches need to be trimmed to 28 inches and reterminated with either a ring terminal (+5v, GND) or an AMP contact #54329-1 (+15v, -15v).

Connection to Crate:

Connect with ring terminals to backplane power bugs.

1. +5v (yellow #12) connect to backplane, right most +5V terminal.
2. GND (white #12) connect to backplane, right most GND terminal.

Terminate into 2 Pos. AMP Connector #54489-2, using crimp contact #53892-4.

- | | |
|-----------------|------------|
| 5. +15v (red) | Circuit 1. |
| 6. -15v (black) | Circuit 2. |

A2 Cable Harness

Power Supply Connector Modification:

Remove the following wires by clipping them as close as possible at the rear of the insert within the cluster housing.

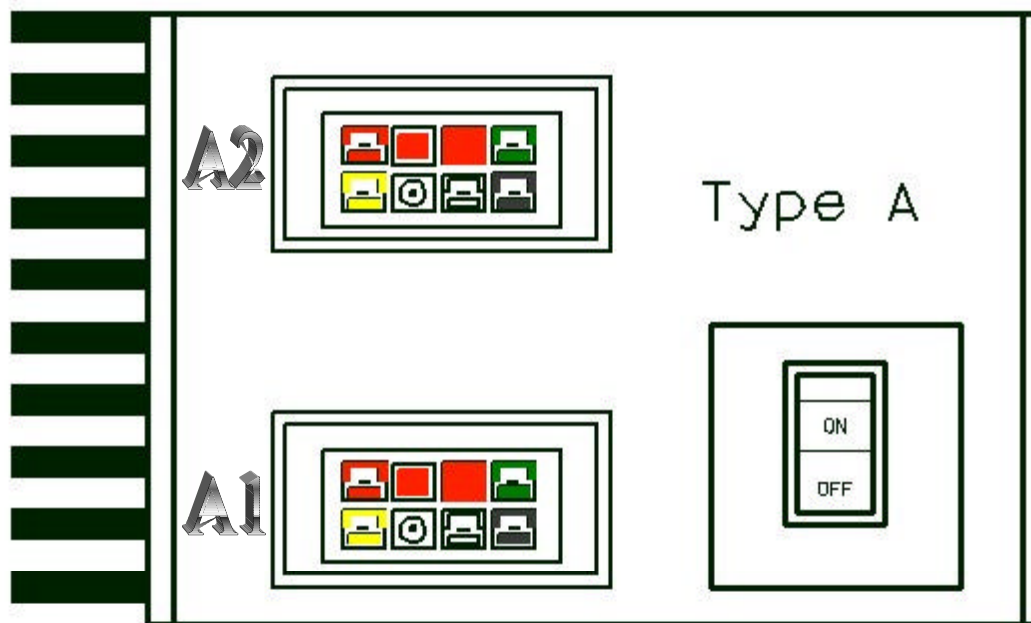
3. -5v (green #12)
4. +15v (red #12)
5. -15v (black #12)
6. GND (white #14)

Note: All remaining wires longer than 28 inches need to be trimmed to 28 inches and reterminated with a ring terminal (+5v, GND).

Connection to Crate:

Connect with ring terminals to backplane power bugs.

3. +5v (yellow #12) connect to backplane, left most +5V terminal.
4. GND (white #12) connect to backplane, left most GND terminal.



A1 Cable Harness



A2 Cable Harness

B1 Cable Harness

Power Supply Connector Modification:

Remove the following wire by clipping it as close as possible at the rear of the insert within the cluster housing.

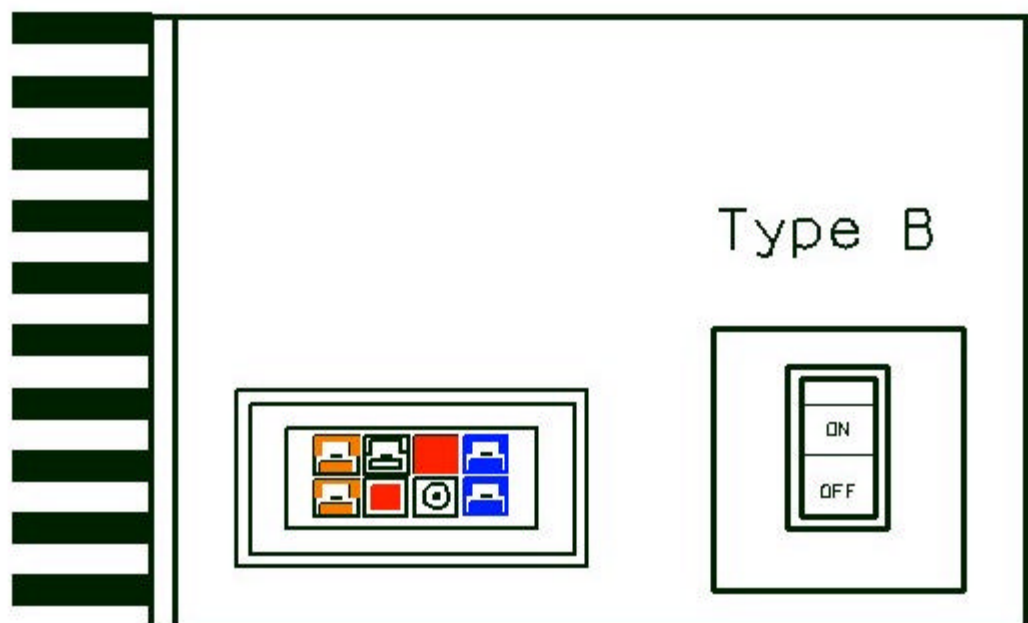
1. -8v (blue #12), the longer of the two blue wires.

Note: All remaining wires longer than 28 inches need to be trimmed to 28 inches and reterminated with a ring terminal

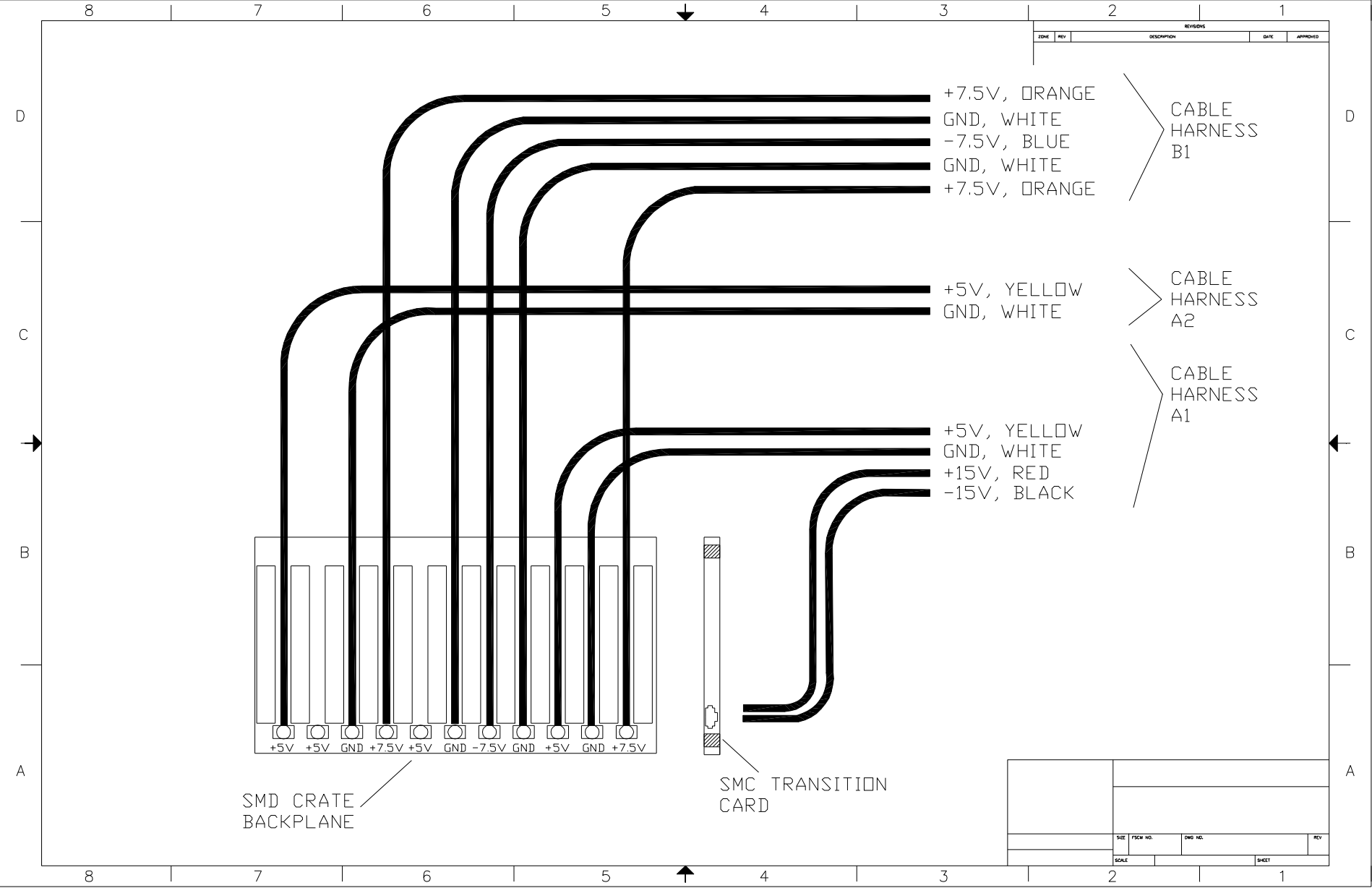
Connection to Crate:

Connect with ring terminals to backplane power bugs.

1. +8 (orange #12) connect to backplane, left most +7.5V terminal.
2. +8 (orange #12) connect to backplane, right most +7.5V terminal.
3. -8 (blue #12) connect to backplane, sole -7.5V terminal.
4. GND (white #12) connect to backplane, GND terminal to right of -7.5V terminal.
5. GND (white #12) connect to backplane, GND terminal to left of -7.5V terminal.



B1 Cable Harness



Belden Wire & Cable - Hook Up And Lead Wire

PVC

UL: 600V, 105°C

CSA: Type TEW

Trade Number: 9912

UL AWM 1015

Conductor:

AWG: 12

Square (mm): (65x30)

Type: TC

Insulation Thickness: 0.031 in.

Nominal OD: 0.158 in.

Standard Lengths	Standard Units(lbs.)
------------------	----------------------

100	3.1
-----	-----

250	7.5
-----	-----

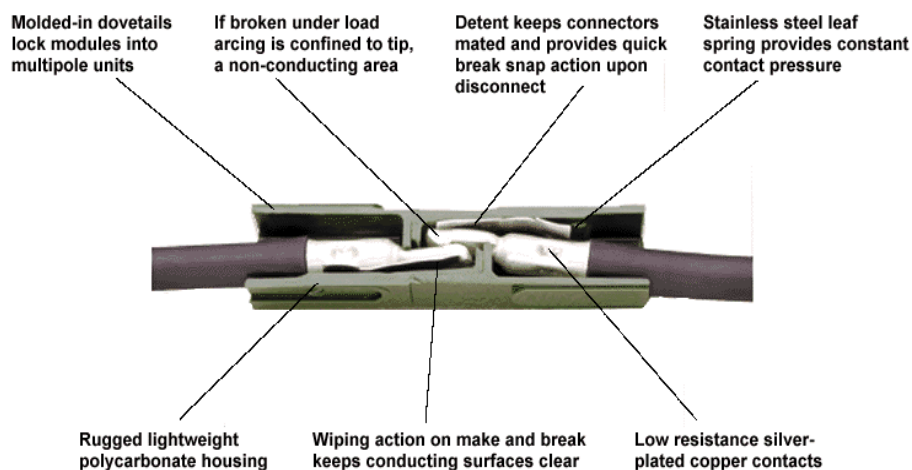
DESCRIPTION



Tinned copper, PVC insulated. Rated 105°C, 600V. Rated 2500V peak for electronic circuits, and internal wiring of electronic and electrical equipment. Passes VW-1 Vertical Wire Flame Test.



Anderson Powerpole® Technical Information

Shown below is a cross section through a connector showing the details of design and construction.



	 10 AMP Housing				 15 amp to 190 amp Housing			
	A		B		C		D	
Current Rating	in.	mm	in.	mm	in.	mm	in.	mm
10 amp	0.32	7.9	0.32	7.9	0.97	24.6	1.63	41.3
15 amp	0.32	7.9	0.32	7.9	0.97	24.6	1.63	41.3
30 amp	0.32	7.9	0.32	7.9	0.97	24.6	1.63	41.3
45 amp	0.32	7.9	0.32	7.9	0.97	24.6	1.63	41.3

75 amp	063	15.9	0.63	15.9	1.88	47.6	3.20	81.4
120 amp	0.88	22.2	0.88	22.2	2.75	69.9	4.63	117.5
180 amp	1.13	28.6	1.13	28.6	3.25	82.6	5.50	139.7

Powerpole Connectors - Operating Characteristics

Connector Model	PP10	PP15	PP30	PP45	PP75	PP120	PP180
UL Current Rating (Ampere)	10	15	30	45	75	120	180
UL Voltage Rating (Volts)	600	600	600	600	600	600	600
Contact Barrel Wire Size Accommodation (AWG)	#14 to #16	#16 to #20	#12 to #16	#10 to #14	#6 to #16	#2 to #8	1/0 to #10
Average Contact Resistance at rated current (Ohms)	0.0022	0.000875	0.0006	0.00053	0.0002	0.000135	0.0001
Average Voltage Drop (Volts)	0.022	0.013	0.018	0.024	0.015	0.0162	0.0175
Insulation withstanding Test voltage (Volts DC) (UL and CSAAC test voltage)	2200	2200	2200	2200	2200	2200	2200
Maximum Wire Insulation Diameter (inches)	0.137	0.175	0.175	0.175	0.437	0.6	0.9
Contact Retention Force (lbs)	25	25	25	35	50	100	170
Connection/Disconnection Force (lbs)	5	3	3	3	7	8	20
Connect/Disconnect Cycles No Load	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Operating Temperature Range (°C)	-20° to 105°	-20° to 105°	-20° to 105°	-20° to 105°	-20° to 105°	-20° to 105°	-20° to 105°
Flammability of Housing Material	UL 94V0						

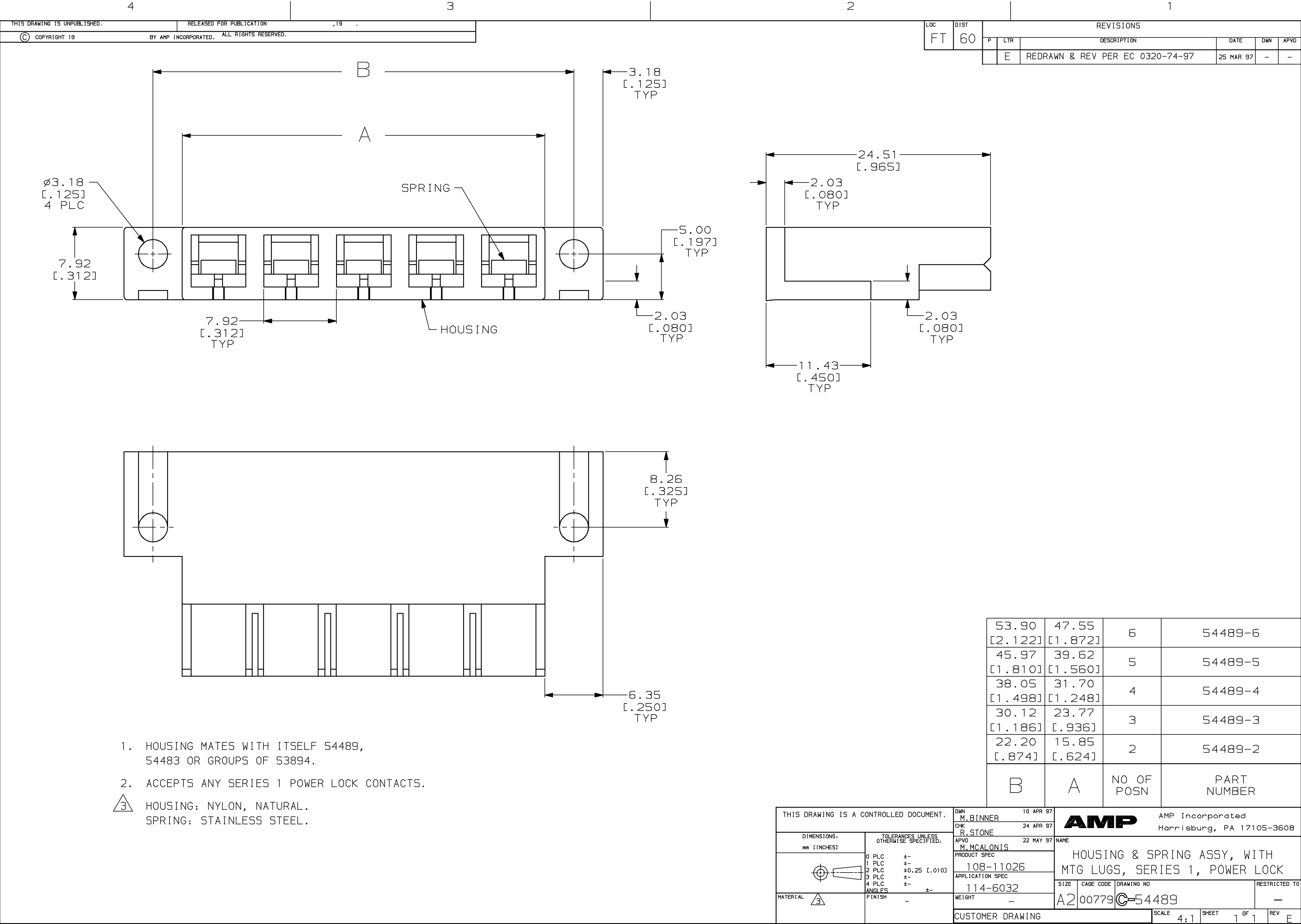


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Webmaster: [Dick Flanagan, W6OLD](#)

Updated February 20, 2000



1. HOUSING MATES WITH ITSELF 54489,
54483 OR GROUPS OF 53894.
2. ACCEPTS ANY SERIES 1 POWER LOCK CONTACTS.
3. HOUSING: NYLON, NATURAL.
SPRING: STAINLESS STEEL.

53.90 [2.122]	47.55 [1.872]	6	54489-6
45.97 [1.810]	39.62 [1.560]	5	54489-5
38.05 [1.498]	31.70 [1.248]	4	54489-4
30.12 [1.186]	23.77 [.936]	3	54489-3
22.20 [.874]	15.85 [.624]	2	54489-2
B	A	NO OF POSN	PART NUMBER

THIS DRAWING IS A CONTROLLED DOCUMENT.		DWN M.BINNER 10 APR 97	AMP Incorporated Harrisburg, PA 17105-3608			
DIMENSIONS: mm [INCHES]		CHK R.STONE 24 APR 97				
TOLERANCES UNLESS OTHERWISE SPECIFIED:		APVD M.MCALONIS 22 MAY 97	NAME			
0 PLC ±- 1 PLC ±- 2 PLC ±0.25 [.010] 3 PLC ±- 4 PLC ±- ANGLES ±- FINISH -		PRODUCT SPEC 108-11026 APPLICATION SPEC 114-6032 WEIGHT -	HOUSING & SPRING ASSY, WITH MTG LUGS, SERIES 1, POWER LOCK			
MATERIAL 3		CUSTOMER DRAWING	SIZE A2	CAGE CODE 00779	DRAWING NO C=54489	RESTRICTED TO -
		SCALE 4:1	SHEET 1	OF 1	REV E	

Connector, Power Lock, Series I

1. SCOPE**1.1. Content**

This specification covers performance, tests and quality requirements for AMP* Power Lock connectors. These connectors are comprised of an assembled insulating housing and electrical contacts and are intended to provide connect/disconnect capabilities for commercial power handling applications. They are designed to accommodate wire sizes 18 through 12 AWG.

1.2. Qualification

When tests are performed on subject product line, procedures specified in AMP 109 series specifications shall be used. All inspections shall be performed using applicable inspection plan and product drawing.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, latest edition of the document applies. In the event of conflict between requirements of this specification and product drawing, product drawing shall take precedence. In the event of conflict between requirements of this specification and referenced documents, this specification shall take precedence.

2.1. AMP Documents

- A. 109-1: General Requirements for Test Specifications
- B. 109 Series: Test Specifications as indicated in Figure 1. (Comply with MIL-STD-202, MIL-STD-1344 and EIA RS-364)
- C. Corporate Bulletin 401-76: Cross-reference between AMP Test Specifications and Military or Commercial Documents
- D. 501-315: Test Report

3. REQUIREMENTS**3.1. Design and Construction**

Product shall be of design, construction and physical dimensions specified on applicable product drawing.

3.2. Materials

- A. Contact: Copper, silver plating
- B. Housing: Polycarbonate or nylon, UL94V-0

3.3. Ratings

- A. Voltage: 600 vac
 B. Current: 31 amperes maximum, See Figure 5

NOTE

Maximum rated current that can be carried by this product is limited by maximum operating temperature of the housings (75°C), and temperature rise of the contacts (30°C). Variables which shall be considered for each application are wire size, connector size, contact material and ambient temperature.

- C. Temperature: -40 to 75°C

3.4. Performance and Test Description

Product is designed to meet electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests shall be performed at ambient environmental conditions per AMP Specification 109-1.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Examination of product.	Meets requirements of product drawing.	Visual, dimensional and functional per applicable quality inspection plan and Certificate of Conformance.
ELECTRICAL		
Termination resistance.	2.5 milliohms maximum.	AMP 109-6-7. Subject mated contacts assembled in housing to 50 mv maximum open circuit at 1 ampere maximum. See Figure 3.
Insulation resistance.	1000 megohms minimum.	AMP Spec 109-28-4. Test between adjacent contacts of mated samples ganged together.
Dielectric withstanding voltage.	1500 vac at sea level.	AMP Spec 109-29-1. Test between adjacent contacts of mated samples ganged together and a metal plate. See Figure 4.
Temperature rise vs current.	30°C maximum temperature rise at specified current of 31 amperes ac.	AMP Spec 109-45-1 and 109-151. Measure temperature rise vs current. See Figures 5 and 6.
MECHANICAL		
Solderability.	Solderable area shall have minimum of 95% solder coverage.	AMP Spec 109-11-2. Subject contacts to solderability.

Figure 1 (cont)

Test Description	Requirement		Procedure
Crimp tensile.	Wire Size (AWG)	Crimp Tensile (Lbs maximum)	AMP Spec 109-16. Determine crimp tensile at maximum rate of 1 inch per minute.
	18	20	
	16	30	
	14	50	
	12	50	
Vibration, sinusoidal.	No discontinuities of 1 microsecond or longer duration. See Note.		AMP Spec 109-21-1. Subject mated samples to 10-55-10 Hz traversed in 1 minute at .06 inch total excursion. 1.3 hours in each of 3 mutually perpendicular planes. See Figure 7.
Physical shock.	No discontinuities of 1 microsecond or longer duration. See Note.		AMP Spec 109-26-2. Subject mated samples to 75 G's half-sine shock pulses of 6 milliseconds duration. 3 shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks.
Durability.	See Note.		AMP Spec 109-27. Mate and unmate samples for 20 cycles at maximum rate of 600 cycles per hour.
Contact retention.	Wire Size (AWG)	Retention Force (Lbs maximum)	AMP Spec 109-30. Apply axial load to contacts by gripping wire and hold for 10 seconds.
	18	10	
	16	15	
	14	20	
	12	20	
Mating force.	10 pounds maximum per contact pair.		AMP Spec 109-42, Condition A. Measure force necessary to mate samples at maximum rate of .5 inch per minute.
Unmating force.	1.75 pounds minimum per contact pair.		AMP Spec 109-42, Condition A. Measure force necessary to unmate samples at maximum rate of .5 inch per minute.
ENVIRONMENTAL			
Thermal shock.	See Note.		AMP Spec 109-22. Subject mated samples to 5 cycles between -55 and 85°C.

Figure 1 (cont)

Test Description	Requirement	Procedure
Humidity-temperature cycling.	See Note.	AMP Spec 109-23-3, Condition B. Subject mated samples to 10 cycles between 25 and 65°C at 95% RH.
Temperature life.	See Note.	AMP Spec 109-43. Subject mated samples to temperature life at 85°C for 1000 hours.
Mixed flowing gas.	See Note.	AMP Spec 109-85-2. Subject mated samples to environmental class II for 14 days.

NOTE

Shall meet visual requirements, show no physical damage and shall meet requirements of additional tests as specified in Test Sequence in Figure 2.

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (a)			
	1	2	3	4
	Test Sequence (b)			
Examination of product	1,10	1,9	1,8	1,3
Termination resistance	3,7	2,7		
Insulation resistance			2,6	
Dielectric withstanding voltage			3,7	
Temperature rise vs current		3,8		
Solderability				2
Crimp tensile	11			
Vibration	5	6(c)		
Physical shock	6			
Contact retention	9			
Durability	4			
Mating force	2			
Unmating force	8			
Thermal shock			4	
Humidity-temperature cycling			5	
Temperature life		5		
Mixed flowing gas		4		

NOTE

- (a) See Para 4.1.A.
 (b) Numbers indicate sequence in which tests are performed.
 (c) Discontinuities shall not be measured. Energize at 18°C level for 100% loadings per AMP Specification 109-151.

Figure 2

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Sample Selection

Samples shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Test group 1 shall consist of 5 contact pairs, each crimped to 4 appropriate wire sizes for single connector assembly. Test group 2 shall consist of 2 connector assemblies, each crimped to 4 appropriate wire sizes for multiple (5 position) connector assemblies. Test group 3 shall consist of 2 assemblies, each mounted on printed circuit boards with mating connectors crimped to 4 appropriate wire sizes. Each contact shall be attached to 1 end of a 24 inch length of wire with a suitable terminal applied to the other for series circuit wiring. Test group 4 shall consist of contacts only.

B. Test Sequence

Qualification inspection shall be verified by testing samples as specified in Figure 2.

4.2. Requalification Testing

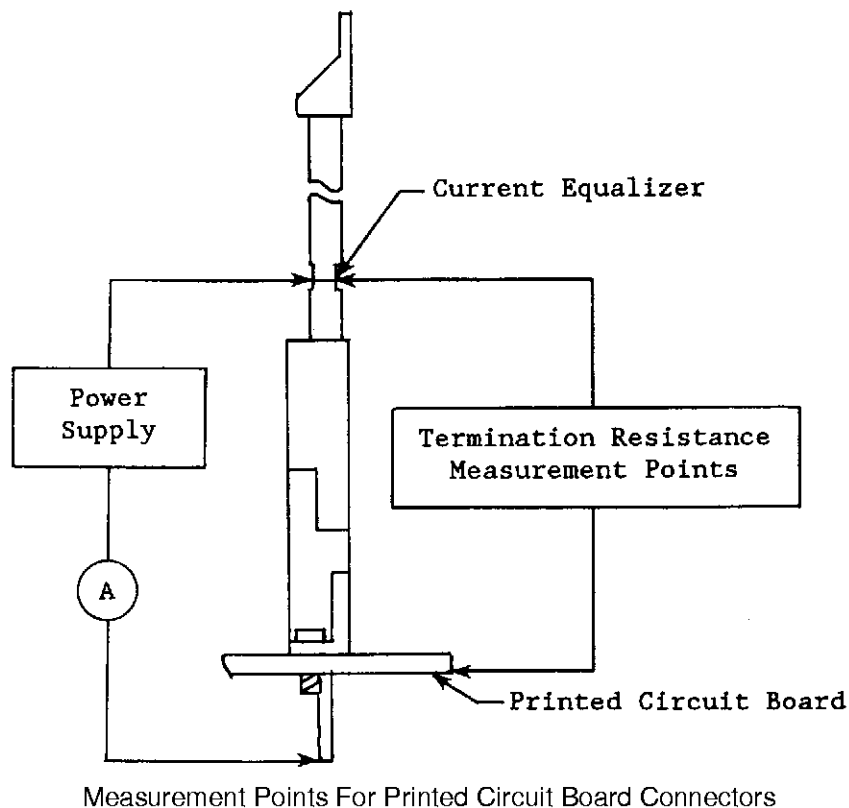
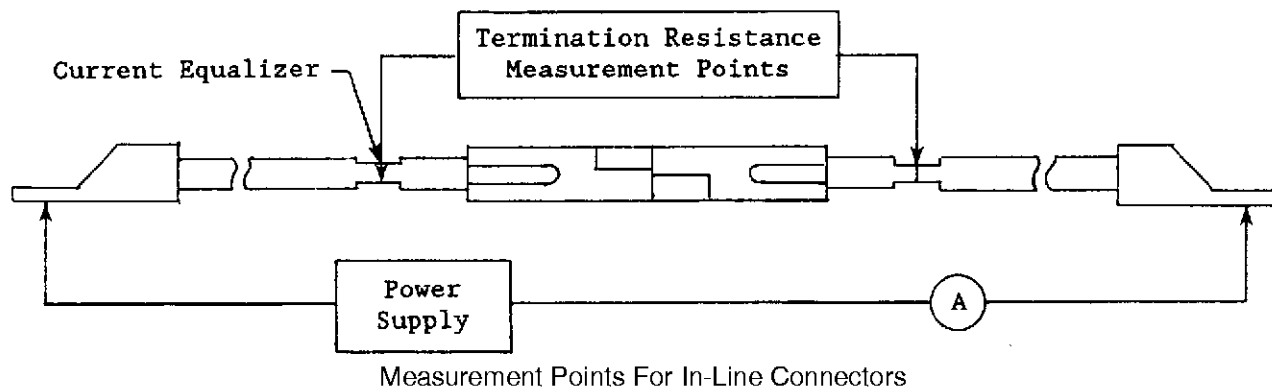
If changes significantly affecting form, fit or function are made to product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of original testing sequence as determined by development/product, quality and reliability engineering.

4.3. Acceptance

Acceptance is based on verification that product meets requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify product. When product failure occurs, corrective action shall be taken and samples resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality Conformance Inspection

Applicable AMP quality inspection plan will specify sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with applicable product drawing and this specification.

**NOTE**

- (a) Current equalizers shall be soldered onto wire at termination resistance measurement points.
- (b) Current equalizers shall be located 3 inches back from wire receiving end of each contact.
- (c) An equal wire length (EWL), equal to the distance between voltage probe points, shall be measured for resistance.
- (d) Termination resistance equals millivolt drop divided by test current less EWL resistance.

Figure 3
Termination Resistance Measurement Points

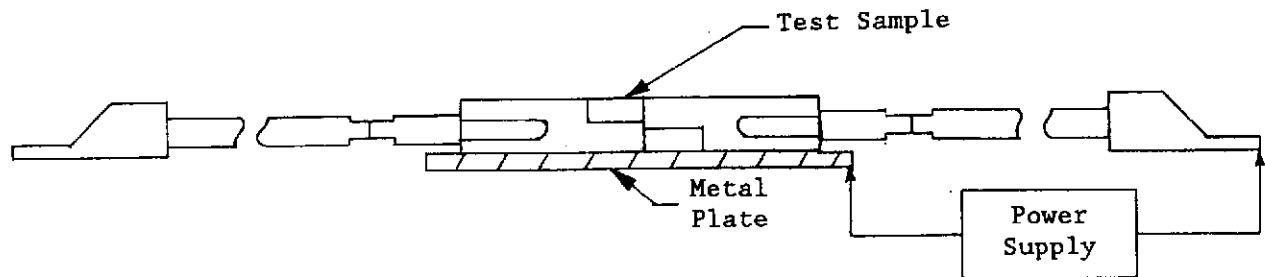


Figure 4
Dielectric Withstanding Voltage

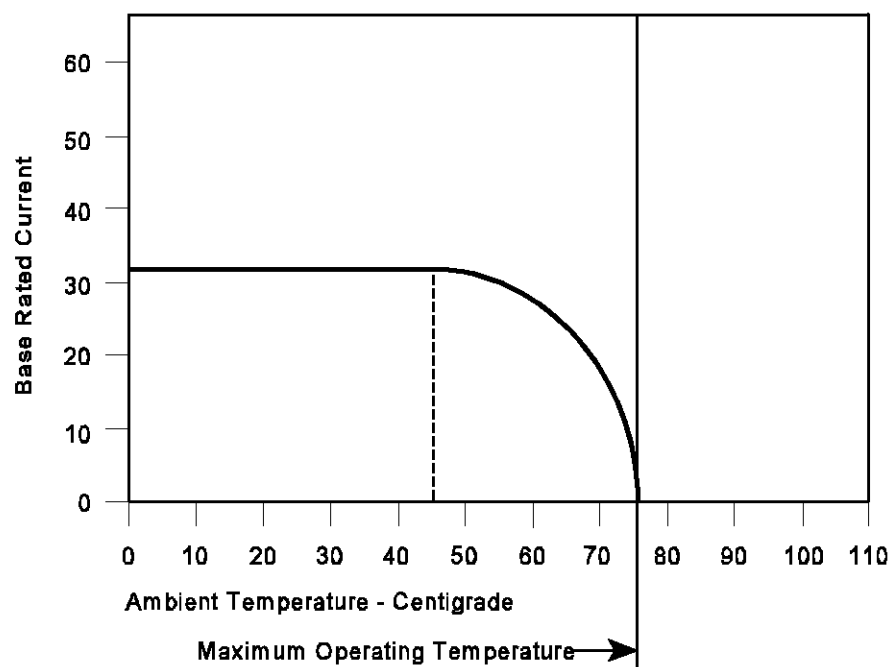


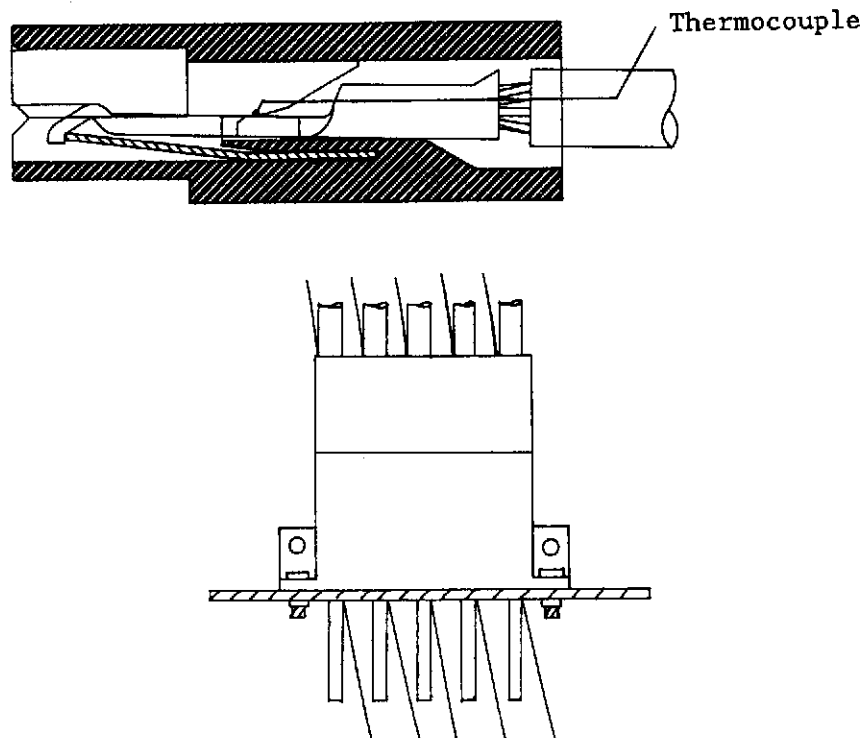
Figure 5A
Current Carrying Capability

Percent Connector Loading	Wire Size AWG			
	18	16	14	12
Single Contact	.56	.71	.85	1
50	.51	.64	.78	.91
100	.43	.55	.66	.78

NOTE

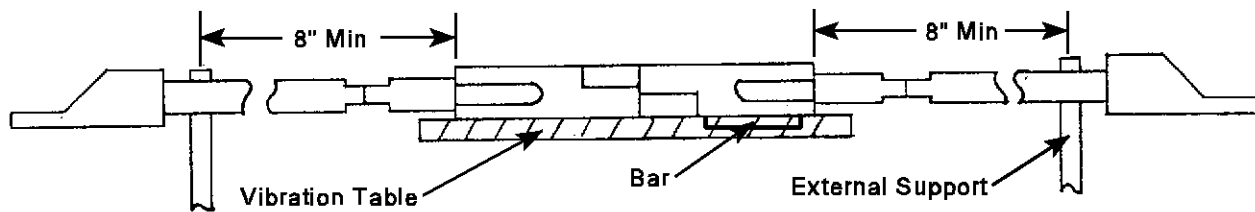
- (a) Unless specifically permitted within NEC, overcurrent protection for the following conductor types shall not be exceeded.
1. 7 amperes for 18 AWG copper wire
 2. 10 amperes for 16 AWG copper wire
 3. 15 amperes for 14 AWG copper wire
 4. 20 amperes for 12 AWG copper wire
- (b) To determine acceptable current carrying capacity for percentage connector loading and wire gage indicated, use Multiplication Factor (F) from above chart and multiply it times Base Rated Current for a single circuit at maximum ambient operating temperature as shown in Figure 5A.

Figure 5B
Current Rating

**NOTE**

- (a) Thermocouples shall be spot welded to contact near intersection of tongue and barrel as shown and coated with thermal conductive epoxy.
- (b) Thermocouple shall exit housing by running down side of wire barrel.
- (c) Printed circuit board shall be modified to allow thermocouple wire to pass through boards.

Figure 6
Thermocouple Mounting

**NOTE**

- (a) Clamp connector rigidly to vibration table.
- (b) Clamp wire a minimum of 8 inches from connector on external support providing sufficient slack in wire to preclude resonance.

Figure 7
Vibration Mounting Fixture

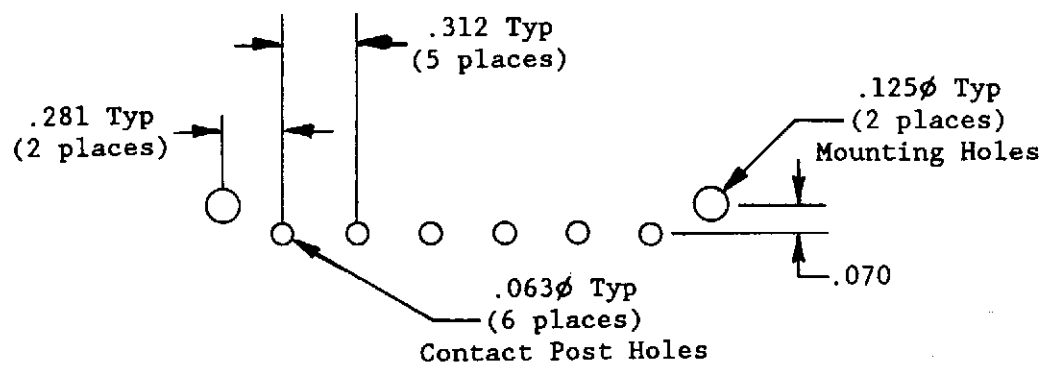
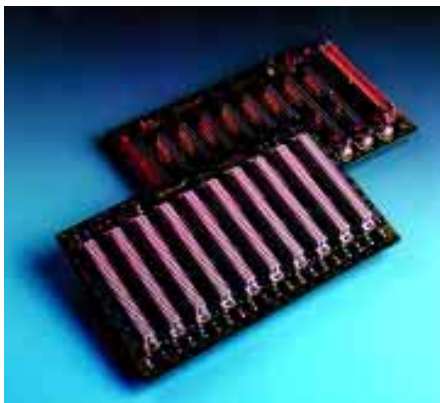


Figure 8
Printed Circuit Board Layout

Backplanes



VME J1 with in-board termination

- Automatic Daisy-Chaining on Bus Grant and IACK signals- standard (manual Daisy-Chaining available upon request).
- Optimum transient response.
- The J1 connector in slot 1 is shrouded on the rear side i.e., for locking levers
- 6-layer construction
- Integrated terminated bus resistors
- Decoupling capacitor between every slot
- Interference suppression capacitors filter the power supply lines (4-slot and more)

Order information

Slots (4HP /20.32mm per slot)	Dimensions Height x Width		VME 16-bit J1 with Automatic Daisy-Chaining
3	130 x 58 mm	5.12" x 2.28"	23000-063
5	130 x 98 mm	5.12" x 3.86"	23000-035
6	130 x 118 mm	5.12" x 4.64"	23000-036
7	130 x 138 mm	5.12" x 5.43"	23000-037
9	130 x 179 mm	5.12" x 7.05"	23000-039
10	130 x 199 mm	5.12" x 7.83"	23000-040
12	130 x 240 mm	5.12" x 9.45"	23000-042
16	130 x 321 mm	5.12" x 12.64"	23000-046
20	130 x 403 mm	5.12" x 15.87"	23000-050
21	130 x 423 mm	5.12" x 16.65"	23000-051

For backplane accessories and hardwaresee page 17

Technical data

Transmission rate	30 MBytes
Base material	EPGC 02 fiberglass epoxy per DIN 40802 (FR 4); flame retardant to UL 94 V-0
Construction	6-layer multilayer: Signal - Signal/Vcc - Vcc - GND/Signal - Signal
Characteristic impedance Z	60 W + 5 W (for all signal lines)
Resistance R (ohms)	≤ 1.5 W (for all signal lines)
Termination	Active/passive switchable
Basic current consumption	< 300 mA (termination active) < 1.3 A (termination passive)
Power supply connections	FASTON, bolt-on or plug-in connections
FASTON	6.3 x 0.8mm ² or 2.8/6.3 x 0.8mm ²
Bolt-on connection	M4
Connectors	Press-fit, class 2 (400 cycles of endurance)
Board thickness	3.2mm / 0.12"

For wire wrap connections, see page 5.

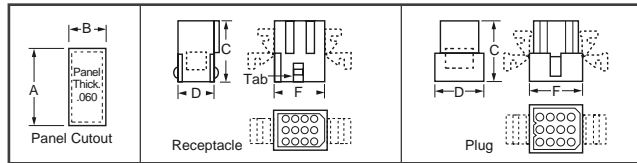
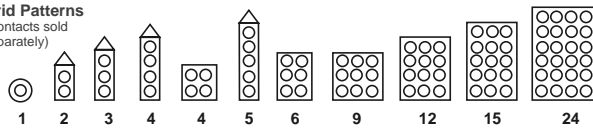
Items highlighted in red are available from stock.

.062" Diameter Connectors

• UL File Number E-29179; CSA File Number LR-19980. • Up to 5 amperes per circuit. • 250 Volt rating. • Friction lock. • Standard color is natural. (* Ratings based on fully loaded housings.)

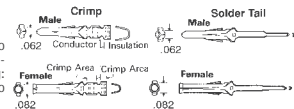
Grid Patterns

(Contacts sold separately)



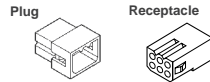
.062" Terminals

Use with .062" housings. Temperature Range: -40°C to 105°C • .008" stock 70/30 brass. High Volt. Test: Withstands 1500 volts RMS for 60 seconds. Current Rating: Amperage rating 5 amps. Storage Temp. Range: -40°C to 125°C. Plating: 200-300µ Hot-Tin Dip tin plating.



Description	Wire Size	Insulation Dia. (Inch)	Digi-Key Part No.	10	500	Molex Part No.
Male, Crimp Type	18-24	.060/.120	WM1000-ND	1.26	10.50	02-06-2103
Female, Crimp Type	18-24	.060/.120	WM1001-ND	1.26	10.50	02-06-1103
Male, Crimp Type	24-30	.040/.090	WM1002-ND	1.26	10.50	02-06-2132
Female, Crimp Type	24-30	.040/.090	WM1003-ND	1.26	10.50	02-06-1132
Male, PCB Solder-Tail	—	—	WM1004-ND	1.89	15.75	02-06-8103
Female, PCB Solder-Tail	—	—	WM1005-ND	1.89	15.75	02-06-7103
Male, Crimp Type	18-24	.060/.120	WM1006-ND*	4.47	37.25	02-06-6103
Female, Crimp Type	24-30	.040/.090	WM1007-ND*	4.02	33.50	02-06-6135
Male, Crimp Type	18-24	.060/.120	WM1008-ND*	4.47	37.25	02-06-5103
Female, Crimp Type	24-30	.040/.090	WM1009-ND*	4.02	33.50	02-06-5135
Male, PCB Solder-Tail	—	—	WM1010-ND*	8.13	67.75	02-06-6122
Female, PCB Solder-Tail	—	—	WM1011-ND*	8.13	67.75	02-06-7104
Hand Tool (Waldom)	—	—	WM9900-ND	13.57 each	—	W-HT-1921
Universal Crimp Tool (Molex)	—	—	WM9999-ND	32.59 each	—	63811-1000
Production Tool (Molex)	—	—	WM9922-ND	223.17 each	—	11-01-0008
Extraction Tool (Molex)	—	—	WM9929-ND	18.42 each	—	11-03-0002

* 15µ Select Gold Finish



Cable Connector Designer Kit

WM9800-ND — Contains all parts needed to assemble male and female connectors from single-circuit to 36-circuit designs (250V and up to 5A/circuit); totals 56 connectors. All have pin terminal size .062" dia. with crimping tool, pin terminal ejector and case \$54.30

Grid Space	Circ. (a)	Type	Max. Amp V.	Dimensions (Inch)			D	Digi-Key Part No.	Pricing	Molex Part No.			
				A	B	C	F		1	100			
<i>.062" Diameter Connector Housings — With Detent Only, Free Hanging</i>													
145°	1	Plug	5 250	—	.750	—	—	WM1201-ND	25	1.79	10.97	03-06-2011	
		Receptacle	5 250	—	.780	—	.183	WM1200-ND	25	1.79	10.97	03-06-1011	
	2	Plug	5 250	.609	.318	.780	.300	.440	WM1220-ND	33	3.08	18.92	03-06-2023
		Receptacle	5 250	.505	.265	.810	.192	.340	WM1230-ND	35	3.29	20.21	03-06-1023
	3	Plug	5 250	.754	.318	.750	.300	.590	WM1221-ND	40	3.75	23.01	03-06-2032
		Receptacle	5 250	.650	.265	.780	.192	.484	WM1231-ND	40	3.75	23.01	03-06-1032
	4	Plug	5 250	.865	.312	.750	.295	.730	WM1222-ND	56	5.32	32.68	03-06-2042
		Receptacle	5 250	.785	.260	.780	.192	.630	WM1232-ND	56	5.32	32.68	03-06-1042
	4 (b)	Plug	5 250	.615	.465	.750	.442	.442	WM1223-ND	57	5.39	33.11	03-06-2044
		Receptacle	5 250	.506	.400	.750	.339	.339	WM1233-ND	57	5.39	33.11	03-06-1044
	5	Plug	5 250	1.044	.318	.750	.310	.890	WM1224-ND	58	5.53	33.97	03-06-2055
		Receptacle	5 250	.940	.265	.780	.192	.775	WM1234-ND	74	6.97	42.79	03-06-1055
	6	Plug	5 250	.615	.607	.750	.600	.450	WM1225-ND	60	5.67	34.83	03-06-2061
		Receptacle	5 250	.552	.505	.780	.494	.344	WM1235-ND	60	5.67	34.83	03-06-1061
	9	Plug	5 250	.752	.615	.750	.590	.590	WM1226-ND	61	5.74	35.26	03-06-2092
		Receptacle	5 250	.650	.552	.780	.494	.489	WM1236-ND	61	5.74	35.26	03-06-1092
12	Plug	5 250	.903	.614	.750	.590	.740	WM1227-ND	64	6.02	36.98	03-06-2122	
	Receptacle	5 250	.795	.563	.780	.494	.634	WM1237-ND	66	6.27	38.49	03-06-1122	
15	Plug	5 250	1.042	.614	.750	.590	.880	WM1228-ND	86	8.12	49.88	03-06-2152	
	Receptacle	5 250	.934	.563	.780	.487	.776	WM1238-ND	102	9.66	59.34	03-06-1152	
24	Plug	5 250	1.182	.765	.750	.740	1.040	WM1229-ND	2.09	19.74	121.26	03-06-2242	

(a) Electrical ratings are per circuit. (b) 4 circuits in square grid pattern.

.084" Power Connectors

Features: • Intermateable, intermountable, and interchangeable with industry standard versions. • Cross tested to assure industry compatibility. • UL recognized, CSA certified. • Up to 13.5 amperes per circuit (30°C rise)*. • 600 Volt rating*. • Positive locks. • Fully isolated contacts. • Circuit I.D. grooves to reduce assembly errors. • Anti-stress positioning tabs to reduce breakage.

Fig. 1 - Plug

Fig. 3 - Vertical Header

Fig. 2 - Cap

Cap Panel Cutout

▲ - Circuit #1 location when using polarizing key option with 2, 3, and 4 circuit housing.
● - Circuit #1 location when using polarizing key option with 6, 9, 12 and 15 circuit housing.

Vertical Header P.C. Board Layout Dim.

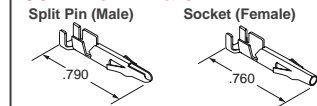
6, 9, 12, & 15 Position Header Assemblies

		Amperes/ Circuit (Max.)*	Voltage Rating (Max.)*	Panel Cutout Dimension (Inch)							Digi-Key Part No.	Pricing				Molex Part No.
Pos.	Des.			A	B	C†	D	E	F	G		1	10	100	500	
Fig. 1 – Plug																
2	Plug	13.5	600	.300	.550	—	—	—	—	—	WM1242-ND	.51	4.47	28.49	110.11	50-84-1020
3	Plug	13.5	600	.300	.800	—	—	—	—	—	WM1244-ND	.55	4.87	31.08	120.12	50-84-1030
4	Plug	13.5	600	.300	1.050	—	—	—	—	—	WM1246-ND	.58	5.10	32.56	125.84	50-84-1040
6	Plug	11.0	600	.800	.550	—	—	—	—	—	WM1248-ND	.68	6.00	38.30	148.01	50-84-1060
9	Plug	11.0	600	.800	.800	—	—	—	—	—	WM1250-ND	.73	6.41	40.89	158.02	50-84-1090
12	Plug	—	600	.800	.800	—	—	—	—	—	WM1252-ND	1.27	11.17	71.23	275.28	50-84-1120
15	Plug	—	600	.800	1.050	—	—	—	—	—	WM1254-ND	1.33	11.72	74.74	288.86	50-84-1150
Fig. 2 – Cap																
2	Cap	13.5	600	.300	.550	.340	.095	.250	.530	.565	WM1243-ND	.53	4.70	29.97	115.83	50-84-2020
3	Cap	13.5	600	.300	.800	.340	.095	.250	.530	.815	WM1245-ND	.59	5.16	32.93	127.27	50-84-2030
9	Cap	11.0	600	.800	.800	.480	.275	.250	1.030	.815	WM1251-ND	.82	7.19	45.88	177.32	50-84-2090
12	Cap	—	600	.800	1.050	.480	.275	.350	1.030	1.065	WM1253-ND	1.48	12.96	82.70	319.61	50-84-2120
15	Cap	—	600	.800	1.300	.480	.275	.350	1.030	1.315	WM1255-ND	1.58	13.86	88.43	341.77	50-84-2150
Fig. 3 – Vertical Header																
2	Male	—	—	.300	.550	—	—	—	—	—	WM1256-ND	.93	8.28	53.40	190.91	10-84-4020
2	Female	—	—	.300	.550	—	—	—	—	—	WM1263-ND	.88	7.75	50.00	178.75	10-84-4022
3	Male	—	—	.300	.800	—	—	—	—	—	WM1257-ND	1.08	9.55	61.60	220.22	10-84-4030
3	Female	—	—	.300	.800	—	—	—	—	—	WM1264-ND	1.03	9.15	59.00	210.93	10-84-4032
4	Male	—	—	.300	1.050	—	—	—	—	—	WM1258-ND	1.29	11.44	73.80	263.84	10-84-4040
4	Female	—	—	.300	1.050	—	—	—	—	—	WM1265-ND	1.25	11.07	71.40	255.26	10-84-4042
6	Male	—	—	.800	.550	—	—	—	—	—	WM1259-ND	1.72	15.25	98.40	351.78	10-84-4060
6	Female	—	—	.800	.550	—	—	—	—	—	WM1266-ND	1.80	15.90	102.60	366.80	10-84-4062
9	Male	—	—	.800	.800	—	—	—	—	—	WM1260-ND	2.23	19.72	127.20	454.74	10-84-4090
9	Female	—	—	.800	.800	—	—	—	—	—	WM1267-ND	2.58	22.88	147.60	527.67	10-84-4092
12	Male	—	—	.800	1.050	—	—	—	—	—	WM1261-ND	2.66	23.53	151.80	542.69	10-84-4120
12	Female	—	—	.800	1.050	—	—	—	—	—	WM1268-ND	3.30	29.23	188.60	674.25	10-84-4122
15	Male	—	—	.800	1.300	—	—	—	—	—	WM1262-ND	3.30	29.23	188.60	674.25	10-84-4150
15	Female	—	—	.800	1.300	—	—	—	—	—	WM1269-ND	3.73	33.05	213.20	762.19	10-84-4152

* Ratings are per circuit, based on fully loaded housings.

†† Cap housing should be installed into panel in the same direction as the panel cutout is punched.

.084" Terminals

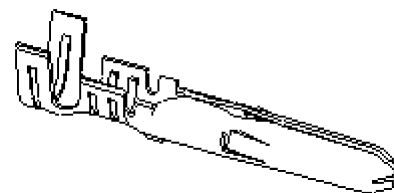


Description	Wire Size AWG Tin Plated	Insulation Dia. (Inch)		Digi-Key Part No.	Pricing				Molex Part No.
		Min.	Max.		10	100	500	1,000	
Male Crimp	#14 to 20	.060	.130	WM1270-ND	1.02	8.50	34.00	51.00	02-08-2004
Female Crimp	#14 to 20	.060	.130	WM1271-ND	1.02	8.50	34.00	51.00	02-08-1002
Hand Tool	#14 to 20	—	—	WM9920-ND		204.82	each		11-01-0167
Extraction Tool	#14 to 20	—	—	WM9921-ND		58.21	each		11-01-0168

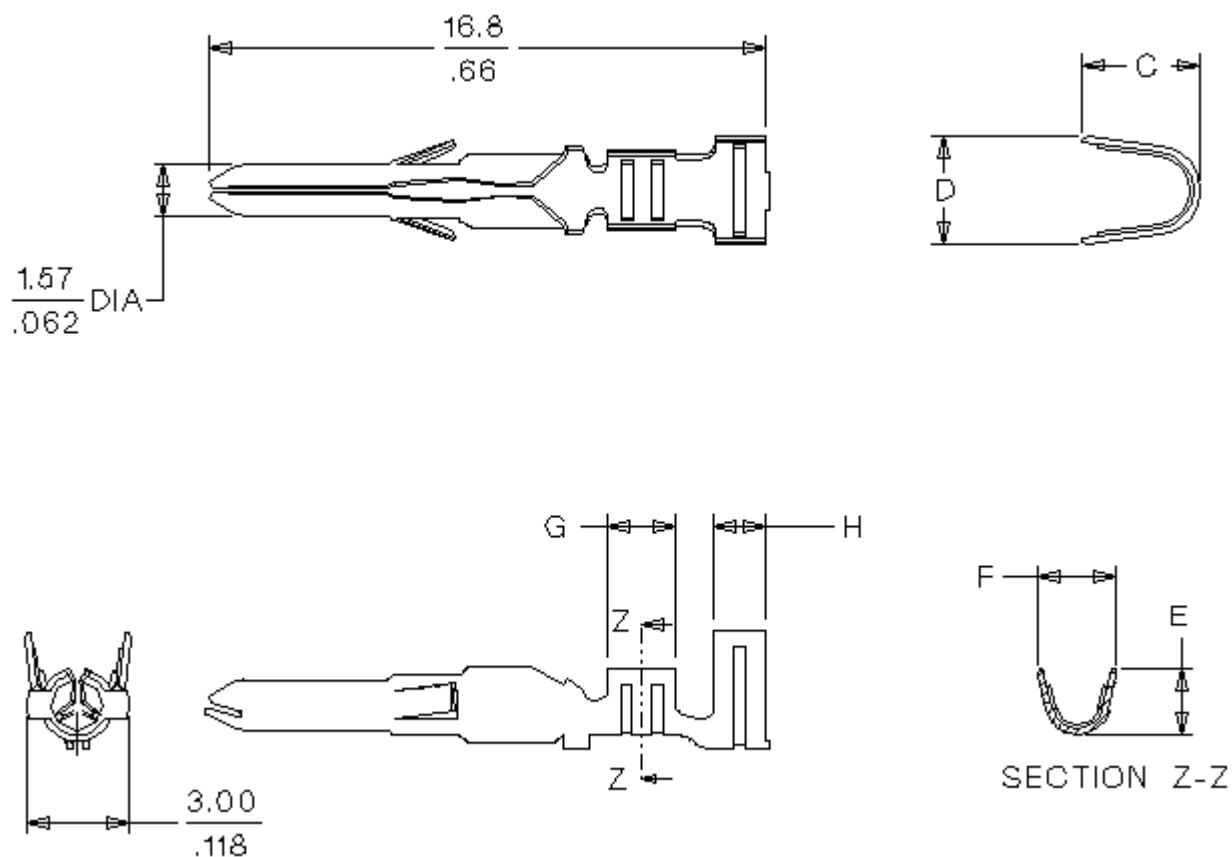


2D Drawing
Order Numbers

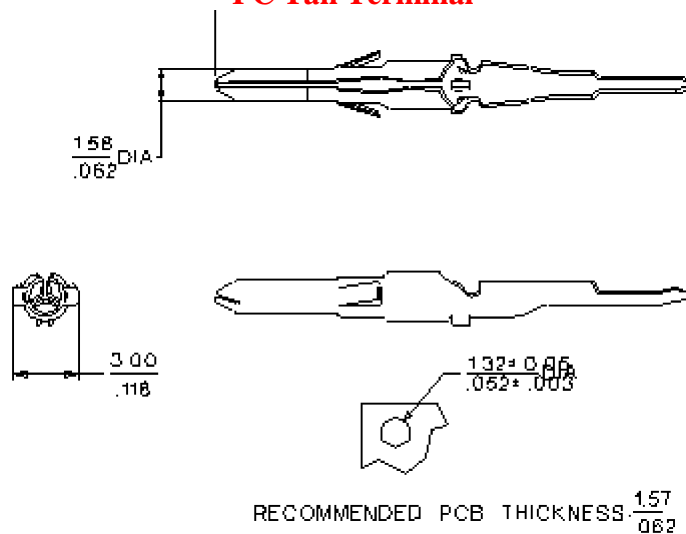
1.57mm (.062") Diameter Male Terminals



Standard Terminal



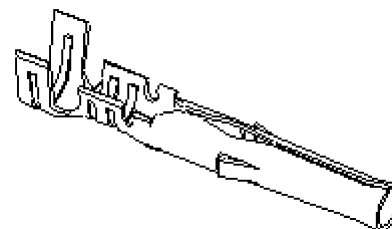
PC Tail Terminal



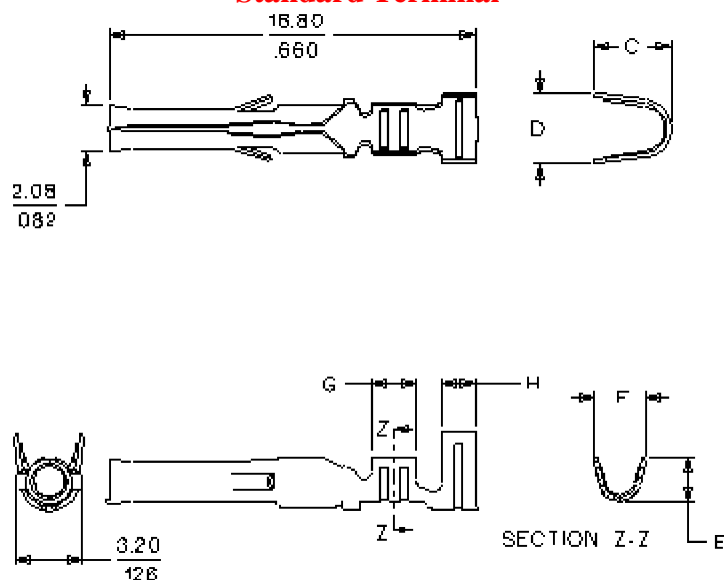


2D Drawing
Order Numbers

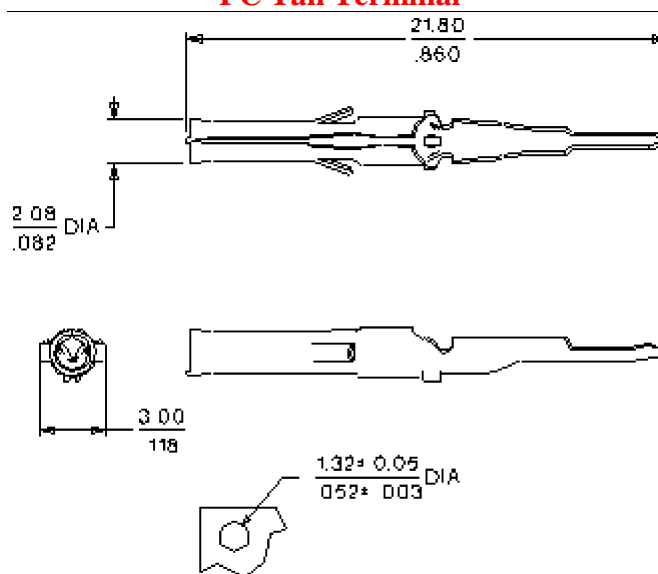
1.57mm (.062") Diameter Female Terminals



Standard Terminal



PC Tail Terminal



RECOMMENDED PCB THICKNESS: $\frac{1.57}{.062}$

Ordering Information Top ↑						
Type	Plating	Crimp Wire Size	Insulation Diameter	Series	Order No.	
					Chain	Loose
Standard Brass .008"	Tin	18-24	1.52/3.05 (.060/.120)	1561	*02-06-1101	*02-06-1103
		24-30	1.02/2.29 (.040/.090)	1855	*02-06-1131	*02-06-1132
	15μ" Gold	18-24	1.52/3.05 (.060/.120)	1561	*02-06-5100	*02-06-5103
		24-30	1.02/2.29 (.040/.090)	1855	*02-06-5130	*02-06-5135
	30μ" Gold	18-24	1.52/3.05 (.060/.120)	1561	02-06-5101	02-06-5102
		24-30	1.02/2.29 (.040/.090)	1855	02-06-5138	02-06-5139
	30μ" Gold Contact Tin/Lead Crimp	18-24	1.52/3.05 (.060/.120)	1561	02-06-5108	02-06-5109
		24-30	1.02/2.29 (.040/.090)	1855	02-06-5147	02-06-5148
	Tin .006"	18-24	1.52/3.05 (.060/.120)	4529	*02-06-1104	*02-06-1105
		24-30	1.02/2.29 (.040/.090)	4559	*02-06-1109	*02-06-1110
Phos-Bronze	Tin .008"	18-24	1.52/3.05 (.060/.120)	1787	*02-06-1201	*02-06-1202
		24-30	1.02/2.29 (.040/.090)	2189	*02-06-1231	*02-06-1232
	.006" Gold (15μ")	18-24	1.52/3.05 (.060/.120)	4529	*02-06-5207	*02-06-5208
		24-30	1.02/2.29 (.040/.090)	4559	*02-06-5211	-
	.008" Gold (15μ")	18-24	1.52/3.05 (.060/.120)	1787	02-06-5201	02-06-5202
.008" PC Tail Brass for Standard .062" Housings Only	Tin	-		1779	-	*02-06-7103
	20μ" Gold Tin/Lead Tail Area	-		1779	-	02-06-7104

*US Standard Product, available through Molex franchised distributors

Terminal Crimp Strength:

AWG Wire Size	Minimum Pull- out Force kg (lb)	AWG Wire Size	Minimum Pull- out Force kg (lb)
18	9.07 (20)	26	2.27 (5)
20	6.80 (15)	28	1.36 (3)
22	4.54 (10)	30	0.91 (2)
24	3.63 (8)	-	-

Engage/Disengage Forces: Miniature terminal of 0.20mm (.008") stock 70/30 Brass.

Average engage/disengage forces in plug/ receptacle connector with +30% tolerance in kg (lb) by circuit:

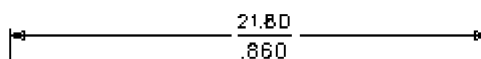
Circuits	Engage/Disengage Force
01	1.04/0.36 (2.30/0.80)
02	2.09/0.73 (4.60/1.60)
03	3.13/1.09 (6.90/2.40)
04	4.17/1.45 (9.20/3.20)
05	5.22/1.81 (11.50/4.00)
06	6.26/2.18 (13.80/4.80)
08	8.35/2.90 (18.40/6.40)
09	9.39/3.27 (20.70/7.20)
12	12.43/4.35 (27.40/9.60)
15	15.65/5.44 (34.50/12.00)
24	25.04/8.71 (55.20/19.20)
36	37.56/13.08 (82.80/28.80)

.006 Phosphor Bronze stock recommended for versions 15 circuits and larger

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Ordering Information Top ↑						
Type	Plating	Crimp Wire Size	Insulation Diameter	Series	Order No.	
					Chain	Loose
Standard Brass .008"	Tin	18-24	1.52/3.05 (.060/.120)	1560	*02-06-2101	*02-06-2103
		24-30	1.02/2.29 (.040/.090)	1854	*02-06-2131	*02-06-2132
	15μ" Gold	*18-24	*1.52/3.05 (.060/.120)	1560	*02-06-6100	*02-06-6103
		24-30	1.02/2.29 (.040/.090)	1854	*02-06-6130	*02-06-6135
	30μ" Gold	18-24	1.52/3.05 (.060/.120)	1560	02-06-6101	02-06-6102
		24-30	1.02/2.29 (.040/.090)	1854	02-06-6138	02-06-6139
	30μ" Gold Contact	18-24	1.52/3.05 (.060/.120)	1560	02-06-6118	02-06-6119
		24-30	1.02/2.29 (.040/.090)	1854	02-06-6143	02-06-6144
	Tin/Lead Crimp	18-24	1.52/3.05 (.060/.120)	1560	02-06-6118	02-06-6119
		24-30	1.02/2.29 (.040/.090)	1854	02-06-6143	02-06-6144
.008" Phos-Bronze	Tin	18-24	1.52/3.05 (.060/.120)	1786	02-06-2201	02-06-2202
		24-30	1.02/2.29 (.040/.090)	2190	02-06-2231	02-06-2232
	Gold (15μ")	18-24	1.52/3.05 (.060/.120)	1786	02-06-6201	02-06-6202
.008" PC Tail Brass for Standard .062" Housings Only	Tin	-	-	1778	-	*02-06-8103
	20μ" Gold Tin/Lead Tail Area	-	-	1778	-	02-06-6122

*US Standard Product, available through Molex franchised distributors

Terminal Crimp Strength:

AWG Wire Size	Minimum Pull- out Force kg (lb)	AWG Wire Size	Minimum Pull- out Force kg (lb)
18	9.07 (20)	26	2.27 (5)
20	6.80 (15)	28	1.36 (3)
22	4.54 (10)	30	0.91 (2)
24	3.63 (8)	-	-

Engage/Disengage Forces: Miniature terminal of 0.20mm (.008") stock 70/30 Brass.

Average engage/disengage forces in plug/ receptacle connector with +30% tolerance in kg (lb) by circuit:

Circuits	Engage/Disengage Force
01	1.04/0.36 (2.30/0.80)
02	2.09/0.73 (4.60/1.60)
03	3.13/1.09 (6.90/2.40)
04	4.17/1.45 (9.20/3.20)
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.006 Phosphor Bronze stock recommended for versions 15 circuits and larger

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